

# **Nuclear Waste: Is There A Need For Federal Interim Storage?**

Report of the Monitored Retrievable Storage Review Commission

November 1, 1989

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# MONITORED RETRIEVABLE STORAGE REVIEW COMMISSION

1825 K Street, NW  
Suite 318  
Washington, DC 20006

202-653-5361

MRS COMM

Alex Radin  
Chairman

Dale E. Klein  
Commissioner

Frank L. Parker  
Commissioner

Jane A. Axelrad  
Executive Director and  
General Counsel

## NUCLEAR WASTE:

### IS THERE A NEED FOR

### FEDERAL INTERIM STORAGE?

## REPORT OF THE MONITORED RETRIEVABLE STORAGE REVIEW COMMISSION

### ERRATA SHEET

The title of Table 4.2 was corrected to delete the word "Public".

Several entries in Tables 6.1 and 6.2 were corrected.

**TABLE 4.2 - TOTAL SPENT FUEL MANAGEMENT LIFE-CYCLE OCCUPATIONAL DOSES  
(PERSON-REM)**

<u>Case</u>	<u>REPOSITORY START DATE</u>		
	<u>2003</u>	<u>2013</u>	<u>2023</u>
No. MRS	16,600	26,100	31,500
Linked MRS (NWPAA) <sup>a</sup>	16,000 <sup>b</sup>	22,300	31,000
Unlinked MRS	16,000 <sup>b</sup>	17,000	18,200

a MRS begins accepting spent fuel three years before repository start date.

b For a 2003 repository start date, the linked and unlinked MRS cases are the same because in both cases the MRS is assumed to start in the year 2000.

**TABLE 6.1 - LOCATION OF SPENT FUEL, MRS IN 2000, REPOSITORY IN 2003<sup>a,b</sup>**

<u>YEAR</u>	<u>DRY STORAGE AT-REACTORS</u>	<u>MRS STORAGE</u>	<u>POOL STORAGE AT- REACTORS</u>	<u>REPOSITORY</u>
1995	1,286	0	29,680	0
2000	3,194	1,200	36,125	0
2005	3,562	12,099	33,273	1,110
2010	2,351	15,000	30,157	12,787
2015	422	15,000	27,862	27,786
2020	174	15,000	19,516	42,785
2025	201	15,000	10,737	57,784
2030	0	9,768	3,592	72,784
2035	0	2,308	543	83,783
2040	0	0	148	86,607
2045	0	0	0	86,756

<sup>a</sup> Source: WACUM Simulator

<sup>b</sup> Shown graphically in Figure 6.1.

**TABLE 6.2 - LOCATION OF SPENT FUEL, NO-MRS, REPOSITORY IN 2013<sup>a,b</sup>**

<u>YEAR</u>	<u>DRY STORAGE AT-REACTORS</u>	<u>MRS STORAGE</u>	<u>POOL STORAGE AT- REACTORS</u>	<u>REPOSITORY</u>
1995	1,286	--	29,680	0
2000	3,711	--	36,807	0
2005	8,019	--	42,026	0
2010	13,932	--	46,362	0
2015	20,007	--	49,914	1,149
2020	20,819	--	43,857	12,798
2025	19,208	--	36,799	27,715
2030	15,459	--	28,037	42,647
2035	8,600	--	20,438	57,596
2040	1,048	--	13,272	72,436
2045	0	--	0	86,756

<sup>a</sup> Source: WACUM Simulator

<sup>b</sup> Shown graphically in Figure 6.2.

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November 1, 1989

The Honorable Thomas S. Foley  
Speaker of the House  
United States House of Representatives  
H-204 Capitol  
Washington, D.C. 20515-6501

The Honorable Robert C. Byrd  
President Pro Tempore  
United States Senate  
Hart Office Building, Suite 311  
Washington, D.C. 20510-1902

Dear Speaker Foley and Senator Byrd:

The Monitored Retrievable Storage Review Commission herewith submits its final report as required by the Nuclear Waste Policy Amendments Act of 1987, Public Law 100-203, as amended by Public Law 100-507.

The Congress created the Commission to provide a report on the need for a Federal monitored retrievable storage facility (MRS) as part of the Nation's nuclear waste management system. In essence, Congress asked the Commission to review the U.S. Secretary of Energy's proposal to create an MRS, evaluate the technical need for an MRS, obtain data and comments from affected parties, and recommend whether such a facility should be included in the nuclear waste management system.

The Commission concludes that the MRS as presently described in the law, which links the capacity and schedule of operation of the MRS to a permanent geologic repository, cannot be justified. The Commission finds, however, that while no single factor would favor an MRS over the No-MRS option, cumulatively the advantages of an MRS would justify the building of an MRS if: (1) there were no linkages between the MRS and the repository; (2) the MRS could be constructed at an early date; and (3) the opening of the repository were delayed considerably beyond its presently scheduled date of operation.

The Commission notes that the Congress, for many years, has expressed concern that an unlinked MRS might be regarded as a de facto repository and could reduce the impetus for proceeding with permanent geologic disposal. The Commission recognizes this expression of Congressional will, as well as similar sentiments voiced during the course of its hearings. Although the Commission does not believe that there is a technical basis for the linkages, the Commission concludes that some linkages are justified.

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Based on our studies, and the conclusions noted above, the Commission has decided that some limited interim storage facilities would be in the national interest to provide for emergencies and other contingencies. The Commission feels that such facilities would be especially desirable in light of delays which have already been experienced as well as additional delays that might be encountered in building a permanent geologic repository. The Commission therefore recommends that the Congress take the following actions:

1. Authorize construction of a Federal Emergency Storage (FES) facility with a capacity limit of 2,000 metric tons of uranium.

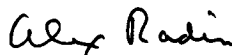
2. Authorize construction of a User-Funded Interim Storage (UFIS) facility with a capacity limit of 5,000 metric tons of uranium. Such a facility would provide only storage, and would be in addition to the FES.

3. Reconsider the subject of interim storage by the year 2000 to: (a) take into account uncertainties that exist today and that might be resolved or clarified within ten years; (b) consider developments that cannot be anticipated today; and (c) evaluate the experience with the two facilities recommended above.

The Commission believes that these recommendations, together with the analyses contained in the report, carry out the mandate given the Commission by the Congress.

We thank you for the opportunity to serve the Congress. It is our hope that the report will assist the Congress as it continues to deliberate on the management and disposal of the Nation's spent nuclear fuel. We stand ready to assist Congress in any way possible to accomplish this goal.

Sincerely,



Alex Radin  
Chairman



Dale E. Klein  
Commissioner



Frank L. Parker  
Commissioner

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# MONITORED RETRIEVABLE STORAGE REVIEW COMMISSION

## COMMISSIONERS

Alex Radin, Chairman  
Dale E. Klein, Ph.D.  
Frank L. Parker, Ph.D.

## COMMISSION STAFF

### EXECUTIVE DIRECTOR AND GENERAL COUNSEL

Jane A. Axelrad

### TECHNICAL STAFF

Sherwood C. Chu, Ph.D.  
Remi B. Langum  
James C. Malaro  
Allan G. Pulsipher, Ph.D.

### EXTERNAL AFFAIRS

Paula N. Alford

### RESEARCH AND EDITORIAL SERVICES

Sauci S. Churchill  
J. D. Brown, D.P.A.  
Anne M. Donovan

### ADMINISTRATIVE STAFF

Nancy L. Creason, Administrative Officer  
Barbara M. Carnes  
Margaret K. Geiger  
Dezebee Tyrone Miles

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# Commission Activities

After being sworn into office on June 14, 1988, the Monitored Retrievable Storage (MRS) Review Commission members assembled and organized a small staff. The Commission operated as a collegial body, with commissioners intimately involved in directing the research and establishing the report writing methodology. From June 14, 1988, until November 1, 1989, the Commission met formally almost every other week. In addition, commissioners traveled individually to gather pertinent information.

All Commission meetings with outside persons or organizations were open to the public. Transcripts of public meetings and routine correspondence were available for review in a Public Document Room at the Commission's offices in Washington, D.C.

The Commission solicited the views of a broad spectrum of people and organizations by holding public hearings in Washington, D.C.; Denver, Colorado; San Francisco, California; and Atlanta, Georgia. (See Appendix A.) The hearings were well attended and produced a wealth of information and insights used during the Commission's deliberations. A total of 173 private citizens, nuclear waste experts, nuclear utility officials, State and local government representatives, Members of Congress, and representatives of citizen and environmental action groups testified, expressing a wide variety of views and, in many instances, submitting statements for the record. Commissioners listened to and questioned each witness concerning the rationale and long-term consequences of his or her recommendations. The Commission also received statements for the record from people unable to attend the hearings. (See Appendix B.)

Throughout its study, the Commission conducted public briefings to gather relevant information. (See Appendix C.) In July 1988, the U.S. Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), Members of Congress and their staffs, the General Accounting Office (GAO), the nuclear industry, the State of Tennessee, and environmental action groups briefed the Commission on monitored retrievable storage work done before the Commission was created.

In September 1988, the Commission requested a series of briefings on specific topics by DOE and NRC representatives. DOE presented information on its ongoing

studies on the need for an MRS facility, rod consolidation, its dry cask storage study, and the status of the repository program. NRC briefed the Commission on its procedures for licensing independent spent fuel storage installations and certifying casks for transportation of spent nuclear fuel.

Soon after its formation, the Commission determined it needed to examine first-hand how utilities and others handle and store spent fuel. In October 1988, the Commissioners and the Commission's Executive Director visited Carolina Power and Light Company's H.B. Robinson Nuclear Project in Hartsville, South Carolina, and Virginia Power Company's Surry Nuclear Power Station in Surry, Virginia. Although these are the only U.S. commercial nuclear power plants currently using at-reactor dry storage facilities for spent fuel, other utilities are exploring the possibility. The facilities' handling and storage of spent fuel were examined, and the utilities' reasons for adopting this type of storage and their plans for the future were discussed.

In addition to those site visits, the Commissioners and Executive Director visited facilities in Sweden, the Federal Republic of Germany, France, and Switzerland to learn about the European experience with spent fuel storage and to examine possible components of an interim storage system. They observed many approaches to spent fuel management ranging from wet centralized storage of spent fuel at CLAB in Sweden to the dry centralized storage of vitrified high-level wastes from reprocessing at La Hague in France. (See Appendix D.)

Following this trip, the Commission held a public briefing in Washington, D.C., in November 1988, to obtain additional information from officials of COGEMA, a French nuclear fuel cycle company. Another briefing followed in December 1988 to obtain information from DOE on its program to construct a permanent repository for the disposal of nuclear waste. Department officials briefed the Commission on efforts to characterize the Yucca Mountain site in Nevada and the schedule for providing a permanent repository for high-level radioactive waste.

In March 1989, DOE provided the Commission with the preliminary results of its system studies on the need for an MRS facility. In May 1989, DOE supplied the final results of those studies and stated the department's current

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position on the need for an MRS facility. At the same meeting, NRC officials briefed the Commission on safeguards issues associated with a potential MRS facility.

The Commission's evaluation focused on a series of alternative waste management strategies. Acting on an early decision to contract for assistance to augment its staff efforts in performing needed complex analyses, initial contracts totaling \$827,836 were awarded in February 1989 to perform five technical tasks and to provide data and analytical tools for the Commission to use in performing its evaluation. The same month, the Commission sent Congress and other interested parties a status report detailing Commission activities to date.

In March 1989, the Commission invited a group of experts to review a draft outline of the report. They represented a wide range of views pertaining to the nuclear waste issues the Commission was examining and provided

their expert perspectives on the scope of the report.

Throughout the summer, the Commission received results of the contractors' work. Contractors' work, which included development of two computer models, augmented technical and public policy work already underway. (See Appendix E.) The Commission also received, in July 1989, the State of Tennessee's final study on the need for an MRS facility. In August, Edison Electric Institute submitted a study on the role of an MRS prepared by Energy Resources International at the request of the Edison Electric Institute/Utility Nuclear Waste and Transportation Program. The Commission held a retreat in August to determine its conclusions and recommendations.

This report, completed during the remaining months of the Commission's existence, reflects the Commission's extensive technical work and public policy deliberations.

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# Executive Summary

About 20,000 metric tons of spent, or used, nuclear fuel have accumulated since the beginning of commercial nuclear power production in the United States. At the end of the currently licensed period of all existing nuclear power plants and those under construction, the amount of spent nuclear fuel is expected to total 87,000 metric tons.

Thus far, practically all of the spent nuclear fuel is stored in water-filled pools at reactor sites. However, space does not exist in the pools to store all the spent fuel expected to accumulate over the lifetime of the reactors. Therefore, other storage must be made available.

U.S. policy is to dispose of spent fuel from nuclear power plants in a permanent underground geologic repository. The objective of permanent disposal is to limit to safe quantities the amount of nuclear waste that might reach the biosphere during the next 10,000 years and beyond.

To achieve that objective, Congress, in the Nuclear Waste Policy Amendments Act of 1987 (NWPAA), designated Yucca Mountain, Nevada, as the candidate site for a repository. Final selection of the Yucca Mountain site was made subject to extensive studies of the suitability of this site and other conditions.

The objective of Congress in adopting the NWPAA was to have a repository available for accepting spent fuel in 1998. However, the U.S. Department of Energy (DOE), which has responsibility for characterizing the Yucca Mountain site, has announced that the opening of the repository will be delayed until 2003, and it is likely that there will be additional delays.

To store spent fuel until the permanent repository is available, a monitored retrievable storage (MRS) facility has been proposed by DOE. The MRS would serve as a means of collecting spent fuel, in excess of that in reactor pools, in a central location, where it would be stored until the fuel can be accepted at the repository. It has also been proposed that the MRS could serve other purposes, such as consolidating the fuel and packaging it for ultimate disposal in the repository.

Facilities similar to an MRS have been proposed since 1972 and have always been the subject of considerable controversy. As recently as 1987, DOE proposed to build an MRS at the Clinch River site near Oak Ridge, Tennessee. In adopting the NWPAA later that year, however, Con-

gress "annulled and revoked" the DOE proposal to locate an MRS in Tennessee.

In the same law, Congress authorized the construction of an MRS but created the Monitored Retrievable Storage Review Commission to study and report to Congress on whether an MRS should be a part of the Nation's nuclear waste disposal system. Essentially, Congress directed the MRS Review Commission to compare the options of a waste disposal system that included an MRS with one that did not include an MRS. The latter, which is known as the No-MRS alternative, would require continued storage of spent nuclear fuel at the more than 70 existing sites of nuclear power plants until the repository is operational.

In the NWPAA, DOE was directed to begin site surveys for an MRS only after the MRS Review Commission had submitted its report to Congress. The NWPAA also limited the capacity of the MRS and linked its construction and operation to the repository schedule.

This report represents the results of almost 18 months of study and deliberations by the MRS Review Commission in response to its mandate from Congress. In addition to its own studies and evaluations, the Commission contracted a number of studies by independent consultants; held extensive public hearings in four locations in the United States; reviewed detailed studies by DOE, the State of Tennessee, and others; received numerous written statements; and visited nuclear waste storage sites in the United States and in four European countries.

As a result of its extensive studies and deliberations, the Commission reached the following conclusions:

**Conclusion No. 1.** From a technical perspective, both the No-MRS and MRS options are safe.

Although neither option is completely without risk, the Commission determined that the risks are expected to be small and within regulatory limits, and the degree of difference in risks is so small that the magnitude of difference should not affect the decision as to whether there should be an MRS.

**Conclusion No. 2.** The net cost of a waste management system that includes an MRS would be lower than previously estimated because of delays that have already occurred in the expected date of repository operation, and the likelihood of further slippages of that date.



The economics of an MRS would become more favorable if the repository were delayed and if the MRS were to accept spent fuel as early as possible. These effects would become especially significant if the repository operation were to be delayed beyond 2013, when there will be a sharp increase in the number of nuclear power plants whose current licenses will expire. If a repository were not in operation by that time, utilities would incur major additional costs that would result from the inability to remove spent fuel from plants being decommissioned. However, a system with an MRS would still be somewhat more costly on a discounted basis than one without an MRS.

**Conclusion No. 3.** There are no single discriminating factors that would cause the MRS alternative to be chosen in preference to the No-MRS alternative.

Although the Commission does not find any single factor that would cause it to favor one alternative, it believes that, cumulatively, there are a number of advantages that would justify a central storage facility not limited in capacity nor linked to the repository schedule and operation. These advantages include storage for emergency purposes; storage for utilities which do not have sufficient space in their spent fuel pools or on-site or which cannot obtain a license for additional at-reactor storage and, hence, might be required to shut down an otherwise satisfactorily operating nuclear power plant; storage for spent fuel from shutdown reactors; economies in the waste management system if an MRS could be completed substantially before the repository; greater redundancy in the system in the event of unforeseen circumstances; more surge capacity to facilitate the flow of spent fuel to the repository; more flexibility in storage options and future waste preparation functions; assistance in standardization; and initiating Federal responsibility for taking possession of spent fuel.

**Conclusion No. 4.** An MRS linked as provided in current law would not be justified, especially in light of uncertainties in the completion time for the repository. Consequently, the Commission does not recommend a linked MRS as required by current law and as proposed by DOE.

The Commission notes that Members of Congress, other public officials, environmental groups, and many private citizens for many years have expressed concern that an unlinked MRS might be regarded as a de facto repository, and thereby would reduce the impetus for building the repository as expeditiously as possible. Although the Commission does not believe that there is a technical basis for the linkages, the Commission agrees that, in light of congressional and other concerns about a de facto repository, some linkages are justified.

However, the schedule linkage presently in the NWPA (MRS construction may not begin until the Nu-

clear Regulatory Commission issues a license for the construction of a repository) would make it impossible for an MRS to be operational more than three years before the repository. Because of delays already experienced in the repository schedule and continued uncertainty surrounding the repository's location and date of operation, the value of the MRS would be greatly diminished if its construction were tied to the schedule of the repository. Most of the need for an MRS would have disappeared, in that utilities would have had to make other arrangements for storage.

**Conclusion No. 5.** Some interim storage facilities, substantially more limited in capacity and built under different conditions than the DOE-proposed MRS, are in the national interest to provide for emergencies and other contingencies.

The Commission recognizes the need to provide certain services that would be in the national interest, but which could not be provided by an MRS restricted by the schedule linkages currently in the law. The Commission concludes that spent fuel storage for emergency and other purposes would be in the national interest. Facilities to fulfill this national interest could be more limited in scope and could be built under different conditions than the DOE-proposed MRS.

In view of the conclusions noted above, and in light of its extensive studies and deliberations, the Commission recommends the following:

**Recommendation No. 1.** Congress should authorize construction of a Federal Emergency Storage (FES) facility with a capacity limit of 2,000 metric tons of uranium (MTU).

In light of the continuing delay in the building of a repository, the Commission believes it would be in the national interest to have available a safety net of storage capacity for emergency purposes, such as an accident at a nuclear power plant, which would make it advantageous to have the plant's spent fuel pool available for decontamination of affected parts of reactors and for storage of debris.

If the facility proposed in Recommendation No. 2 were not available, the FES also could be used to store spent fuel from otherwise satisfactorily operating nuclear power plants that would have to be shut down because of insufficient on-site storage.

Because the FES would be designed primarily for emergency use and, hence, would serve as "insurance" for the entire industry, the Commission recommends that the cost of this facility should be paid from the Nuclear Waste Fund, to which all of the utilities which generate power from nuclear energy contribute.

**Recommendation No. 2.** Congress should authorize construction of a User-Funded Interim Storage (UFIS) facility with a capacity limit of 5,000 MTU. Such a facility

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would provide storage only, and would be used in addition to the Federal Emergency Storage facility proposed in Recommendation No. 1.

Although spent fuel can be stored safely at reactor sites for as long as 100 years, some utilities may not have space on-site for life-of-plant storage or may not be able to obtain a license for additional storage.

In view of the uncertainties regarding the availability of a repository, the Commission believes it would not be in the national interest to force utilities to shut down operation of otherwise satisfactorily operating nuclear power plants because of lack of storage capacity for spent fuel. Congress recognized this problem by authorizing, in Section 135 of the Nuclear Waste Policy Act of 1982, a Federal Interim Storage facility (FIS). It is the Commission's intention that the 5,000 metric ton storage facility that it recommends likewise should be available in such contingencies.

This facility also should provide storage for: (a) shut-down reactors at sites where a utility no longer operates nuclear power facilities, and (b) utilities which would prefer to ship spent fuel to this facility rather than retain it on-site.

In view of the uncertainties which have existed as to the time of operation of the MRS and the repository, many utilities with newer reactors have already taken steps to provide needed life-of-plant storage, while others have expressed a preference for providing such storage themselves rather than relying on an MRS. For these reasons, the Commission believes it would be more equitable for the storage facility (UFIS) to be user funded, so that only those utilities that chose to use the facility would pay for it.

**Recommendation No. 3.** Congress should reconsider the subject of interim storage by the year 2000 to:

(a) take into account uncertainties that exist today and which might be resolved or clarified within 10 years, (b) consider developments which cannot be anticipated today, and (c) evaluate the experience with the two facilities recommended above.

Many uncertainties make it extremely difficult to plan for long-term interim storage of spent fuel. Although the opening of the repository is the most notable uncertainty, many other questions also must be resolved.

The Commission believes that the actions recommended above should be adequate to take care of the needs of interim storage at least until the year 2006. However, by the year 2000, Congress should reconsider the question of interim storage of spent fuel. At that time, Congress should take into account, among other things, such factors as: status of the repository; status of nuclear power plants; availability of at-reactor storage; utilization and adequacy of the 2,000 metric ton Federal Emergency Storage facility and the 5,000 metric ton User-Funded Interim Storage facility; status of technological developments in the storage of spent fuel; nuclear waste system optimization; and the fee schedule established for the UFIS.

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The Monitored Retrievable Storage Review Commission believes that these recommendations would provide safe interim storage of spent nuclear fuel, would be consistent with the goals of the national nuclear waste management system, and would provide for flexibility and unforeseen contingencies.